UNIVERSITI SAINS MALAYSIA

Second Semester Examination
2013/2014 Academic Session

June 2014

EEM 421 – QUALITY TECHNIQUES

[KAEDAH KUALITI]

Duration 3 hours
[Masa : 3 jam]

Please check that this examination paper consists of **ELEVEN (11)** pages and Appendix **SATU (1)** pages of printed material before you begin the examination.

*[Sila pastikan bahawa kertas peperiksaan ini mengandungi **SEBELAS (11)** muka surat dan Lampiran **SATU (1)** muka surat bercetak sebelum anda memulakan peperiksaan ini]*

Instructions: This question paper consists **FIVE (5)** questions. Answer **ALL** questions. All questions carry the same marks.

*[**Arahan:** Kertas soalan ini mengandungi **LIMA (5)** soalan. Jawab **SEMUA** soalan. Semua soalan membawa jumlah markah yang sama]*

Use separate answer booklets for **Part A** and **Part B**
*[Gunakan dua buku jawapan yang berasingan bagi **Bahagian A** dan **Bahagian B**]*

Answer to any question must start on a new page.
[Mulakan jawapan anda untuk setiap soalan pada muka surat yang baru]

"In the event of any discrepancies, the English version shall be used".

[Sekiranya terdapat sebarang percanggahan pada soalan peperiksaan, versi Bahasa Inggeris hendaklah diguna pakai]

…2/-

PART A
BAHAGIAN A

1. (a) Define the terms `Quality Assurance' and `Statistics'. Explain why statistics represent the foundation of quality assurance activities.

Beri definasi istilah `Jaminan Kualiti' dan `Statistik'. Terangkan kenapa statistik merupakan asas dalam aktiviti jaminan kualiti.

(30 marks/ markah)

(b) Draw the 'Evolution of Quality Principles' flow graph and briefly describe each principle.

Lukiskan rajah aliran 'Evolution of Quality Principles' dan terangkan secara ringkas setiap prinsip.

(30 marks/ markah)

(c) What is Dr. W. Edwards Deming famous for? Explain his major contribution in improving process quality.

Untuk apakah Dr. W. Edwards Deming terkenal? Terangkan sumbangan terbesar beliau dalam meningkatkan kuantiti proses.

(40 marks/ markah)

2. (a) Compare the steps in PDSA and DMAIC by showing them side by side in a table. Discuss the similarities and differences based on your understanding.

Bandingkan langkah-langkah di dalam PDSA dan DMAIC dengan ditunjukkan bersebelahan di dalam satu jadual. Bincangkan persamaan dan perbezaan mereka berdasarkan pemahaman anda.

(30 marks/ markah)

…3/-

(b) List down 7 tools or techniques used in problem solving.

Senaraikan tujuh (7) alat atau teknik yang digunakan di dalam penyelesaian masalah.

(20 marks /markah)

(c) Explain the required steps to construct a cause-and-effect diagram. Help your explaination by drawing a cause-and-effect diagram.

Terangkan langkah yang diperlukan untuk membina gambarajah sebab-dan-akibat. Lukis gambarajah sebab-dan-akibat untuk membantu penerangan kamu.

(20 marks/ markah)

(d) Based on your reading and experience, discuss three (3) problems that you may face in implementing PDSA and propose the solutions in implementing PDSA.

Berdasarkan pembacaan dan pengalaman anda, bincangkan tiga (3) permasalahan yang mungkin dihadapi di dalam melaksanakan PDSA dan cadangkan penyelesaian di dalam melaksanakan PDSA.

(30 marks/ markah)

3. (a) Why do engineers and statisticians perform statistical analysis?
Kenapakah jurutera melakukan analisis statistik?

(10 marks/markah)

(b) What is the Normal Distribution (Gauss Distribution)?
Apakah yang dimaksudkan dengan Taburan Normal (Taburan Gauss)?
(10 marks/markah)

(c) Why do people perform Normality Test?
Kenapakah Ujian Kenormalan dilakukan? (10 marks/markah)

(d) When a person informs you that he is taking 30 data sample, which theorem is he referring to?

Apabila seseorang memberitahu bahawa ia sedang mengambil 30 sampel data, teorem yang manakah yang dirujuknya?

(5 marks/markah)

(e) Explain the importance of the theorem that is mentioned for question (c).

Terangkan kepentingan teorem yang disebut untuk bahagian (c).

(15 marks/markah)

(f) Feedback from Customer, the center pin for the assembly of 3 units were loose and dropped from the connector assembly at male mating. Instruments using the pin and bead were failing Sensitivity and Reflection significantly. The manufacturing Engineer would like to perform a study whether loctice (adhesive) was applied on the beads. Two samples were taken with locative (control) and without loctice (eval) application and performed break-away torque.

Results from the experiment using Statgraphic Software and fill in the blanks

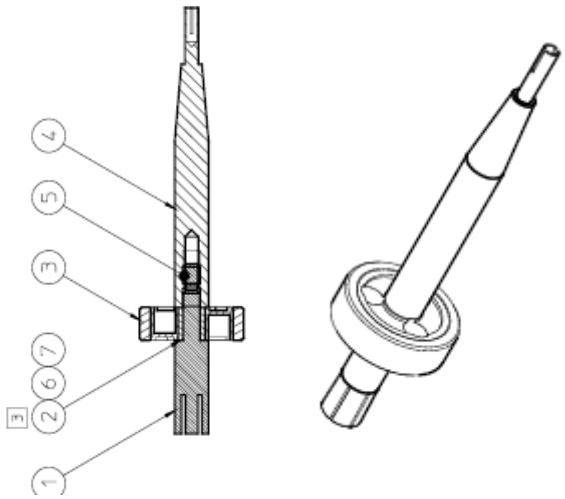
(50 marks/markah)

Tests for Normality for Loctite
Computed Chi-Square goodness-of-fit statistic = 1347.96
P-Value = 0.0
Shapiro-Wilks W statistic = 0.881702
P-Value = 0.0
Z score for skewness = 0.287781
P-Value = 0.77351
Z score for kurtosis = -4.7987
P-Value = 0.00000159907

Tests for Normality for Without Loctite
Computed Chi-Square goodness-of-fit statistic = 349.6
P-Value = 0.0
Shapiro-Wilks W statistic = 0.795299
P-Value = 6.93294E-9
Z score for skewness = 0.866256
P-Value = 0.386348
Z score for kurtosis = 0.63398
P-Value = 0.526091

Comparison of Means (assuming equal variances)
95.0% confidence interval for mean of Loctite:
14.164 +/- 0.348613 [13.8154,14.5126]
95.0% confidence interval for mean of Without Loctite:
9.34 +/- 0.187023 [9.15298,9.52702]
95.0% confidence interval for the difference between the means
assuming equal variances: 4.824 +/- 0.784173 [4.03983,5.60817]
t test to compare means
Null hypothesis: mean1 = mean2
Alt. hypothesis: mean1 NE mean2
assuming equal variances: t = 12.1063 P-value = 0.0

Comparison of Means (not assuming equal variances)
95.0% confidence interval for mean of Loctite:
14.164 +/- 0.348613 [13.8154,14.5126]
95.0% confidence interval for mean of Without Loctite:
9.34 +/- 0.187023 [9.15298,9.52702]
95.0% confidence interval for the difference between the means
not assuming equal variances: 4.824 +/- 0.393579 [4.03976,5.60824]
t test to compare means
Null hypothesis: mean1 = mean2
Alt. hypothesis: mean1 NE mean2
not assuming equal variances: t = 24.1227 P-value = 0.0



Variance Check
Cochran's C test: 0.947606 P-Value = 0.0
Bartlett's test: 1.35965 P-Value = 0.0
Hartley's test: 18.0862
Levene's test: 41.5091 P-Value = 4.70216E-10

Comparison of Medians
Median of sample 1: 15.0
Median of sample 2: 9.0

Mann-Whitney (Wilcoxon) W test to compare medians
Null hypothesis: median1 = median2
Alt. hypothesis: median1 NE median2
Average rank of sample 1: 173.632
Average rank of sample 2: 34.84
W = 467.0 P-value = 0.0

Hypothesis Statement:

Ho : Breakaway Torque Pin & Bead between Loctite and without Loctite is similar.

H_A : _____ **(5 marks)**

Normality Test;

Loctite (C) _____ (p =_____), **(4 marks)**

Without Loctite (E) _____(p = _____) **(4 marks)**

Therefore data _____, **(4 marks)**

Variance Check

Data Not Normal *Or* Normal; Ho : $\sigma_C = \sigma_E$; H_A: $\sigma_C \neq \sigma_E$

_____ Test, p = _____, therefore σ between Loctite (C) and without Loctite (E)

(4 marks)

is _____. **(4 marks)**

Test for Median _____; **(2 marks)**

Ho : $_C = _E$; H_A : $_C \neq _E$ **(6 marks)**

P = _____, therefore _____ is _____ different for Breakaway Torque Pin & Bead.

(5 marks)

Results:

Since _____ Test and _____ show _____ difference; thus accept _____.

(7 marks)

Conclusions:

_____ **(5 marks)**

…7/-

PART B
BAHAGIAN B

4. Read the following scenario and determine how this organisation is implementing on Design for Manufacturing (DFM).

Baca senario berikut dan tentukan bagaimanakah Rekabentuk untuk Pembuatan (DFM) dipraktik di dalam organisasi ini.

A local computer-based company in Pulau Pinang recently decided to introduce a new class of hard disc product that can be set to work as either a striped or mirrored array. The company's management team, hoping to build upon their initial success, sought additional opportunities to develop this product. They are particularly interested in opportunities to extend their brand to other types of swappable drive bays to make it easy to move drives in and out of the of the enclosure as shown in Figure 1.

Sebuah syarikat berasaskan komputer tempatan di Pulau Pinang baru-baru ini memutuskan untuk memperkenalkan produk cakera keras yang boleh diletakkan secara berjajar atau tatasusunan cermin. Pihak pengurusan berharap untuk membina kejayaan awal mereka dengan mencari peluang tambahan untuk membangunkan produk ini. Mereka berminat pada peluang-peluang bagi meningkatkan jenama mereka dengan memperkenalkan cakera boleh-silih bagi memudahkan ia ditukar di dalam dan di luar tingkap seperti yang ditunjukkan dalam Rajah 1.

Figure 1 : Propose a new class of hard drive
Rajah 1 : Cadangan kelas baru untuk cakera keras

…8/-

This company is a small company, and so an investment in developing a new product represents substantial financial risk. As a result, the team hoped to identify:-

Syarikat ini adalah sebuah syarikat kecil, dan pelaburan dalam membangunkan produk baru terdedah kepada risiko kewangan yang ketara. Untuk itu, pasukan ini berharap untuk mengenal pasti: -

(a) **FIVE** points of consideration as key design principle for DFM that should be taken into account.

LIMA *pertimbangan sebagai prinsip reka bentuk utama untuk DFM yang perlu diambil kira.*

(10 marks/markah)

(b) The management team has to decide how the team member will interact and they have to choose either to use an approach of the sequential product development or concurrent product development for the project. Choose one of the approach and explain the reason?

Pasukan pengurusan perlu membuat keputusan bagaimana ahli pasukan akan berinteraksi dan mereka perlu memilih untuk menggunakan pendekatan daripada pembangunan produk berurutan atau pembangunan produk serentak bagi projek tersebut. Pilih salah satu daripada pendekatan dan terangkan sebabnya?

(30 marks/markah)

(c) Figure 2 shows the graph of product cost vs time. Describe the introduction of a new product with respect to the graph.

Rajah 2 menunjukkan kos produk lawan masa. Terangkan pengesahan produk baru berpandukan rajah tersebut.

(60 marks/markah)

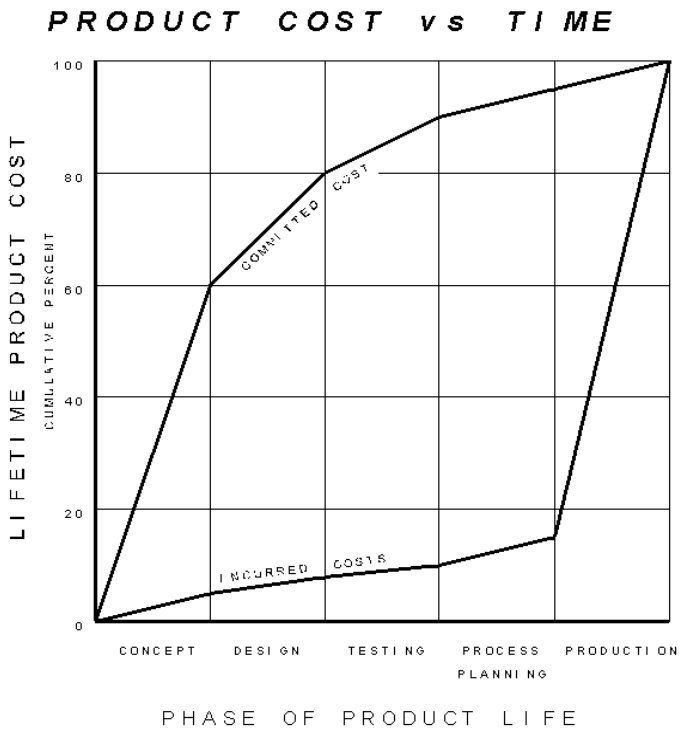


Figure 2 : Product Cost vs Time

Rajah 2 : Kos Produk lawan Masa

5. (a) A company manufactures shafts for construction equipment. The LSL and USL values for the length of the shafts are 44 mm and 46 mm respectively. 5 consecutive shafts are obtained from the cutting process every 30 minutes by the quality assurance inspector. Their lengths are measured. X bar and R control charts are then constructed for the length data. Both charts are found to be in statistical control. The CL, LCL, and UCL values for both charts are as shown in Table 5.1.

Sebuah syarikat menghasilkan aci untuk peralatan binaan. Nilai LSL dan USL untuk panjang aci adalah 44 mm dan 46 mm masing-masing. 5 aci diambil secara berturut-turut dari proses pemotongan setiap 30 minit oleh pemeriksa jaminan kualiti. Kepanjangan aci diukur. Carta kawalan X bar dan R dibina untuk data kepanjangan. Kedua-dua carta didapati berada di dalam kawalan berstatistik. Nilai CL, LCL, dan UCL kedua-dua carta adalah seperti yang dipaparkan di dalam Jadual 5.1.

Table 5.1
Jadual 5.1

Garisan Kawalan	X bar	R
CL	45.25	1.05
LCL	44.65	0
UCL	45.86	2.22

(i) Estimate the process parameters μ and σ, and determine the Cp and Cpk values. Show all of your workings.

Anggarkan parameter proses μ and σ , dan tentukan nilai bagi Cp dan Cpk. Tunjuk semua perjalanan kerja.

(40 marks/ markah)

(ii) Is the company able to meet the specification limits for the length of the shafts? Provide reasons for your answers as well as appropriate recommendations to the company's upper management.

Adakah syarikat dapat memenuhi had spesifikasi untuk kepanjangan aci? Beri sebab untuk jawapan anda serta cadangan yang sesuai kepada pihak atasan syarikat.

(40 marks/ markah)

(b) Suppose the company's design team has developed a new machine for the cutting process and would like to assess the stability of the machine. The team plans to use the machine to produce 20 shafts and to measure the length of the shafts. Which type of control charts should be used to evaluate the measured length of the shafts? Provide reasons for your answers.

Andaikan pasukan rekabentuk syarikat telah membangunkan mesin yang baru untuk proses memotong dan ingin menilai kestabilan mesin tersebut. Pasukan tersebut bercadang untuk mengguna mesin bagi menghasilkan 20 aci dan mengukur kepanjangan aci. Jenis carta kawalan yang manakah patut digunakan untuk menilai ukuran kepanjangan aci? Beri sebab untuk jawapan anda.

(20 marks/ markah)

ooo0ooo